REMARKS

The present application is a continuation application of U.S. Application No. 10/286,815 filed November 4, 2002.

The present Preliminary Amendment is being filed together with the continuation application papers.

Claims 19 to 36 now are presented for examination. Claims 19, 23, 28 and 32 are the independent claims. Claims 1 to 18 have been cancelled herein. Claims 19 to 36 are newly presented herein.

Applicant has submitted herewith a copy of the original specification filed in Application No. 10/286,815, together with a substitute specification including formal amendments to the specification. A marked-up copy of the original specification indicating the formal amendments also is submitted herewith. No new matter has been added.

Applicant notes that the present continuation application includes a copy of the drawings filed with original Application No. 10/286,815; however a substitute sheet of drawings (Replacement Sheet) for Figure 2 has been submitted herewith, including a formal amendment thereto, as previously submitted in parent Application No. 10/286,815.

Also filed concurrently herewith is an Information Disclosure Statement citing the art of record in parent Application No. 10/286,815.

Favorable consideration of the application and early passage to issue respectfully are requested.

Applicant's undersigned attorney may be reached in our Washington, D.C. office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

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(Substitute Specification of Continuation Appln. No. 10/286,815)

(Marked-up Version)

TITLE

IMAGE FORMING APPARATUS HAVING CHANGE-OVER TYPE DEVELOPING DEVICE

--This is a Continuation Application of Application No. 10/286,815, filed November 4, 2002 (allowed), the entire contents of which is incorporated herein by reference.--

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an image forming apparatus comprising a latent image bearing member and developing means having a plurality of developing devices and provided opposite ~~to~~ the latent image bearing member at a predetermined developing position.

Related Background Art

Various types of ~~Although~~ conventional color image developing apparatuses are known. A ~~apparatues include various different types, a~~ developing step common to these various types of apparatuses involves separating ~~for color~~

~~separation of~~ an original image either into three colors of yellow, magenta and cyan, or four colors, additionally including black, and forming an electrostatic latent image for each color on a latent image bearing member (e.g., a photosensitive drum 202, (as shown in FIG. 1). Each electrostatic latent image then is ~~so as to be~~ developed with ~~with a~~ toner by a developing device of a ~~the~~ corresponding color. In this ~~is included commonly. According to the~~ developing step, the developing device of each color executes the developing operation at a position adjacent to (or in contact ~~contacting~~ with) the latent image bearing member. In one type of system, ~~As the developing device arrangement configuration, a system with~~ the developing devices of all the colors are disposed adjacent to the latent image bearing member; in another type of system, ~~and a system provided with~~ a developing device change-over portion sequentially brings the ~~for bringing a~~ developing devices ~~device~~ of the corresponding colors ~~color~~ into the vicinity of ~~to~~ (or into contact with) the latent image bearing member ~~are involved~~.

Various systems for ~~Here, according to the system of~~ changing over the developing devices, including a slide mounting system, a rotary drum system (also ~~or, it is~~ referred to ~~also~~ as a rotary color developing system), and ~~or~~ the like are known, with ~~included, but many of them are put into practice by~~ the rotary drum system being common. Referring to Fig. 1, in the ~~The~~ rotary drum system a stepping motor (not show) rotates ~~is a system for development according to the rotating operation of~~ a rotary color developing device 203 ~~of FIG. 1~~ around a rotation shaft 200 ~~by rotation of a stepping motor (not shown)~~ so as to selectively bring a predetermined developing device 221 to 224 adjacent to or in contact with

the latent image bearing member 202. The ~~of the~~ developing devices 221 to 224 selectively are provided according to the separated color to be developed ~~a developing position adjacent to (or in contact with) the photosensitive drum 202~~. Therefore, compared with the configuration in which ~~with~~ the developing devices of respective colors are disposed around the photosensitive drum, this configuration ~~as the latent image bearing member, it~~ is advantageous in that it permits a reduction in size ~~a size reduction~~ of the apparatus, and establishes a common architecture for ~~of~~ the developing devices. The common architecture for the developing devices permits individual replacement of the developing devices as process cartridges, thus reducing toner supply problems and achieving a significant cost reduction ~~can be achieved. Particularly in the case of providing the developing devices themselves as the replaceable process cartridges in order to avoid troubles and labors accompanied by the toner supply, advantage by the common architecture of the developing devices is significant in terms of the cost~~.

However, in ~~according to~~ the rotary drum system, the rotary color developing device 203 takes time to rotate when the developing devices change over. This change-over time is greater than the processing time of the slide-mounting system ~~should be rotated at the time of changing over the developing devices, and thus it is disadvantageous in terms of the processing time in that the developing device change-over time is long compared with the slide mounting system~~. This disadvantage significantly influences, in particular, First Copy Output Time (FCOT), that is ~~on the FCOT (First Copy Output Time) as~~ the time for outputting the first sheet of paper from the start of ~~the~~ image formation ~~forming step~~ in a ~~the~~ rotary drum system having ~~with~~ all ~~the~~ four colors (yellow, magenta,

cyan, black) mounted in a ~~the~~ rotary color developing device for monochrome or color development.

For example, in the case of a rotary color developing device 203 with ~~the~~ developing devices of black, yellow, magenta, and cyan mounted in this order, a developing operation is executed by rotating ~~operation of~~ the rotary color developing device 203 around the rotation shaft 200, with ~~according to rotation of~~ a rotary stepping motor, so as to selectively bring a predetermined developing device of ~~in response to~~ the color to be developed initially to a developing position adjacent to (or in contact with) the photosensitive drum 202. In ~~around the rotation shaft 200. That is, in~~ the case of ~~the~~ monochrome development, the initial color ~~it~~ is black, and in the case of ~~it is~~ color development, it is yellow. However, it cannot be determined ~~determination cannot be made to~~ which of the black or ~~and~~ yellow developing devices the rotary color developing device 203 should be switched to until it is determined ~~turned out~~ whether the initial ~~first original~~ image is ~~for~~ a monochrome image or a color image. Therefore, the electrostatic latent image formation ~~starting~~ start timing is ~~a timing~~ calculated based on ~~from~~ the developing device change-over completion scheduled time so that rotation of the rotary color developing device 203 is started after determining ~~revealing~~ whether the original image is ~~for~~ a monochrome image or a color image. Thus, ~~and thus~~ the time needed for changing over the developing device delays ~~is delay time for~~ the electrostatic latent image formation starting time ~~timing~~. This limitation has been an ~~the~~ obstacle for shortening the FCOT.

SUMMARY OF THE INVENTION

The present invention has been achieved in response to the above-mentioned problems. An ~~In consideration of the above-mentioned problems, the present invention has been achieved, and an~~ object of the present invention is to provide an image forming apparatus comprising a latent image bearing member and a developing portion having a plurality of developing devices, wherein the real average value of the FCOT is ~~can be~~ shortened by ~~according to control of~~ starting movement of a predetermined developing device to a predetermined position before determining ~~determination of~~ the kind of ~~the inputted~~ input image.

Specifically, in a color image forming apparatus using a rotary drum type developing device change-over system having a latent image bearing member and a plurality of developing devices, such as a color electrophotography copying machine or ~~and~~ a color electrophotography printer, ~~an effect of shortening~~ the real average value of the FCOT is reduced by preliminarily rotating the rotary color developing device to a predetermined position at the time ~~of receiving~~ an image formation ~~starting~~ start command is received ~~can be provided~~.

Moreover, the real average value of FCOT is reduced in an image forming apparatus comprising a latent image bearing member and a developing device having a plurality of developing devices ~~and~~ provided opposite ~~to~~ the latent image bearing member. Such an apparatus provides ~~, since~~ an input ~~inputting~~ portion for inputting an image signal, an auto-discriminating portion for automatically discriminating the kind of input ~~an inputted~~ image, and a control portion having a first mode for executing monochrome image formation, a second mode for executing color image formation, and an auto-selecting mode for changing over between the first mode and the second mode according to the determination of the

auto-discriminating portion. In the case where the auto-selecting mode is selected, the ~~, the~~ control portion is ~~being~~ capable of controlling initial ~~such that~~ movement of a predetermined developing device to a predetermined position ~~is started~~ before the auto-discriminating portion makes the determination. At ~~in the case the auto-selecting mode is selected, are provided, at~~ the time ~~of starting the~~ image formation is started in the auto-selecting mode, the developing device can be brought into the vicinity of the developing position ~~so as to shorten the real average value of the FCOT~~ by preliminarily rotating the developing device changeover portion to a standby position. This preliminary movement reduces the real average value of FCOT. The developing device then is ~~as the predetermined position so as to be~~ rotated through the remaining angle to the developing position of the developing device after it is determined ~~making a determination of~~ whether the image to be formed is a monochrome image or a color image ~~colored~~.

~~Furthermore, in an image forming apparatus comprising a latent image bearing member and a developing device having a plurality of developing devices and provided opposite to the latent image bearing member, since an inputting portion for inputting an image signal, an auto-discriminating portion for automatically discriminating the kind of an inputted image, and a control portion having~~

¶Alternatively, the control portion may have a first mode for executing image formation using a first developing device, a second mode for executing image formation without using the first developing device, and an auto-selecting mode for changing over between the first mode and the second mode according to the determination of the auto-discriminating portion. In the case the auto-selecting

mode is selected, the ~~, the~~ control portion is ~~being~~ capable of controlling initial ~~such that~~ movement of a predetermined developing device to a predetermined position ~~is started~~ before the auto-discriminating portion makes the determination. At ~~in the case the auto-selecting mode is selected, are provided, at~~ the time ~~of starting the~~ image formation is started in the auto-selecting mode, the developing device can be brought into the vicinity of the developing position ~~so as to shorten the real average value of the FCOT~~ by preliminarily rotating the developing device change-over portion to a standby position. This preliminary movement reduces the real average value of FCOT. The developing device then is ~~as the predetermined position so as to be~~ rotated through the remaining angle to the developing position of the developing device according to the kind of image to be formed.

Moreover, since the standby position can be set by an operator or set automatically according to the frequency of ~~in~~ use of ~~the~~ monochrome and ~~the~~ color by ~~in~~ the image forming apparatus, the real average value of the FCOT can be reduced ~~shortened~~ according to the use conditions.

Furthermore, the real average value of FCOT can be reduced in an ~~the~~ image forming apparatus which uses ~~for using~~ toners of different concentrations and components depending on ~~according to~~ the mode because the control portion initiates ~~, since it is controlled such that~~ movement of a predetermined developing device to a predetermined position ~~is started~~ before ~~making determination on~~ the kind of input ~~the inputted~~ image is determined ~~, the real average value of the FCOT can be shortened~~.

For ~~That is, for~~ example, the user can set the apparatus in monochrome or color mode based on which one is used most frequently, and the ~~since the mode with a high frequency of use is set by the operator or set automatically between the monochrome mode and the color mode, and the~~ standby position corresponding to the selected mode is selected accordingly. Again, ~~with the priority, and~~ the rotary color developing device is rotated preliminarily, and the real average value of the FCOT is reduced ~~can be shortened~~. Other objects, advantages and characteristics of the present invention will become apparent from the description and the drawings below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic cross-sectional view showing the entire schematic configuration of a color image forming apparatus according to an embodiment of the present invention.

FIG. 2 is a perspective view showing the essential part configuration of a light writing optical system.

FIG. 3 is a block diagram showing the essential part configuration of a control portion.

FIG. 4 is a diagram showing the relationship between a rotary color developing device and a control portion.

FIG. 5 is a diagram showing the configuration of an operating portion 303.

FIG. 6 is a diagram showing the standard screen of an LCD on an operating portion.

FIG. 7 is a diagram showing the essential part configuration of a digital image processing portion.

FIG. 8 is a block diagram showing the essential part configuration of a printer processing portion.

FIGS. 9A, 9B, 9C, 9D, 9E and 9F are diagrams showing the stopping positions of a rotary color developing device.

FIG. 10 is a chart showing the flow of ~~the~~ control.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, with reference to the accompanying drawings, a color image forming apparatus 50 of an embodiment of the present invention will be explained. In the drawings, ~~the~~ members designated by the same reference numerals represent the same members. Therefore, ~~and the~~ redundant explanation will be omitted.

FIG. 1 is a schematic cross-sectional view of the color image forming apparatus 50. The color image forming apparatus 50 comprises a color image reader portion 1 (hereinafter referred to as the "reader portion 1") in the upper part, and a color image printer portion 2 (hereinafter referred to as the "printer portion 2") in the lower part.

First, the configuration of the reader portion 1 will be explained. The reader portion includes an ~~An~~ original glass stand (platen) 101 and an auto original feeder (~~it is~~ also referred to as the ADF) 102 ~~are provided~~. A configuration which includes ~~with~~ a mirror surface pressure plate or a white pressure plate (not shown) ~~mounted~~ instead of the ADF 102 can also be employed. As light sources 103, 104 for illuminating the original, a ~~light source, such as a~~ halogen lamp, a fluorescent

lamp, or a xenon lamp can be used. The reader portion also includes reflective troughs ~~Troffers~~ 105, 106 for condensing respective light beams ~~a light beam~~ from the light sources 103, 104 onto an original; ~~the original,~~ mirrors 107, 108, 109; and ~~, and~~ a lens 110 for condensing a reflected light beam or a projected light beam from the original onto a CCD (charge coupled device) image sensor (hereinafter referred to as the CCD) 111~~, are provided~~. A substrate 112 on which ~~with~~ the CCD 111 is mounted, a control portion 100 for controlling the entire image forming apparatus, and a digital image processing portion 113 also correspond to ~~include~~ the 500 series portion (excluding the CCD 111) in FIG. 7 and the portions designated by the numerals 401, 402 in FIG. 8. A carriage 114 holds the light sources 103, 104, the reflective troughs ~~troffers~~ 105, 106, and the mirror 107. A carriage 115 holds the mirrors 108, 109. The carriage 114 is moved at a speed V, and the carriage 115 is moved mechanically at a speed V/2 ~~mechanically~~ in the sub-scanning direction Y orthogonal to the electrical ~~electrically~~ scanning direction (the main ~~a main~~ scanning direction X) of the CCD 111 so as to scan the entire surface of the original. An external interface (I/F) interfacing with the other devices 116 is connected electrically with the digital image processing portion 113.

Next, the configuration of the printer portion 2 will be explained. A printer control I/F 218 receives a control signal from a CPU 301 of the control portion 100 described later. Printer ~~, so that the printer~~ portion 2 operates based on the control signal it receives from the printer control I/F 218. A photosensitive drum 202 is rotated counterclockwise. An electrostatic latent image is formed on the photosensitive drum 202 by a laser scanner 201. Developing devices 221, 222, 223, 224 corresponding to black, yellow, magenta, and cyan colors, respectively,

are disposed around the rotation shaft 200. To form ~~At the time of forming~~ a toner image on the photosensitive drum 202, when ~~in the case~~ a color image is being formed, a developing operation is executed. In this developing operation, ~~according to a rotating operation of a~~ rotary color developing device 203 is rotated around rotation shaft 200 by rotation of a stepping motor (not shown) such that a predetermined developing device of the developing devices 221 to 224 is selectively brought into a developing position adjacent to (or in contact with) the photosensitive drum 202. The developing device is selected ~~around the rotation shaft 200~~ according to the separated color to be developed. The ~~From the~~ developing devices 221 to 224 supply~~, a toner is supplied by~~ an amount of toner corresponding to the charge on the photosensitive drum 202, so as to develop the electrostatic latent image on the photosensitive drum 202.

In this embodiment, ~~the~~ developing devices 221 to 224 are mounted ~~are easily detachably mountable~~ to the rotary color developing device 203 such that they are easily detachable. In the rotary color developing device 203, installation positions corresponding to the black, yellow, magenta, and cyan colors, respectively, are designated in the clockwise direction. The developing devices 221 to 224 of respective colors are mounted at the designated color positions. When ~~At the time of developing~~ a black monochrome image is to be formed, only the black developing device 221 is used. The ~~such that the~~ rotary developing device 203 is rotated so as to bring a sleeve (not shown) of the black developing device 221 into a position opposite ~~to~~ the photosensitive drum 202 for toner supply. When ~~At the time of~~ developing a full color image, all of the developing devices 221 to 224 are used. The ~~such that the~~ rotary color developing device 203 is rotated so as to bring

the sleeve of each developing device into a developing ~~visualizing~~ position 226 opposite ~~to~~ the photosensitive drum 202 in the order of black, yellow, magenta and cyan. A toner image formed on the photosensitive drum 202 is transferred onto an intermediate transfer member 205 rotating in the clockwise direction, ~~according to~~ consistent with rotation in the counterclockwise direction of the photosensitive drum 202. The transfer onto the intermediate transfer member 205 is completed in one revolution of the intermediate transfer member 205 in the case of a ~~the~~ black monochrome image, and in four revolutions of the intermediate transfer member 205 in the case of a ~~the~~ full color image. When ~~In the case of~~ forming an image of a ~~specific~~ sheet size~~, for example, an~~ of A4 size or less, two images ~~of these sizes~~ can be formed on the intermediate transfer member 205.

A ~~On one hand, a~~ sheet (recording paper) picked up by a pickup roller 211 or 212 from an upper stage cassette 208 or a lower stage cassette 209 and fed by a feed roller 213 or 214 is transported to a registration roller 219 by a transport roller 215. At a ~~the~~ timing when ~~of finishing the~~ transfer onto the intermediate transfer member 205 is completed, the sheet begins passing ~~is transported~~ between the intermediate transfer member 205 and a ~~the~~ transfer belt 206. Thereafter, the sheet is transported by the transfer belt 206 and ~~as well as~~ pressed on the intermediate transfer member 205 so that the toner image on the intermediate transfer member 205 is transferred onto the sheet. The toner image transferred onto ~~on~~ the sheet is pressed and heated ~~and pressured~~ by a fixing roller 207a and a pressure roller 207b so as to be fixed on the sheet. The sheet with the image fixed thereon is delivered to a face up delivery port 217.

Residual ~~The residual~~ toner remaining on the intermediate transfer member 205, that is, toner which is not ~~without being~~ transferred onto ~~on~~ the sheet, ~~sheet~~ is cleaned off of the intermediate transfer member 205 during ~~in the~~ post process control in the latter half of the image formation sequence. In ~~the~~ post process control, the residual toner on the intermediate transfer member 205, after finishing ~~the~~ transfer onto ~~on~~ the sheet, ~~sheet~~ is charged to a ~~in the~~ polarity opposite ~~to~~ the original toner polarity by a cleaning roller 230 in FIG. 1, ~~1~~ as ~~the~~ waste toner, so that the residual toner having ~~in~~ the opposite polarity is transferred again on the photosensitive drum 202. In the photosensitive drum unit, the opposite polarity residual toner is scraped ~~scrapped~~ off ~~from~~ the drum surface by a blade (not shown) and then ~~so as to be~~ transported to a waste toner box 231 provided integrally in the photosensitive drum unit. Thus ~~Accordingly~~, the residual toner on the intermediate transfer member 205 is cleaned completely, thereby finishing ~~so as to finish the~~ post process control.

In FIG. 1, ~~in~~ the printer portion 2 further includes a manually-inserted-sheet trailing edge detecting sensor S1, a manually-inserted-sheet presence or absence sensor S2, an intermediate plate position sensor S3, an ante-registration sensor S4, a separation jamming sensor S5, an inverter sensor S6, a duplex sensor S7, a re-feed sensor S8, an upper stage second sheet absence sensor S9, an upper stage sheet absence sensor S10, a lower stage second sheet absence sensor S11, a lower stage sheet absence sensor S12, a manually-inserted-sheet feed roller 216, a charger 290, fixing delivery rollers 291, inverter rollers 292, and duplex rollers 293 ~~are provided~~.

FIG. 2 is a diagram showing the schematic configuration of a laser scanner 201. A laser beam corresponding to an image data signal output ~~outputted~~ from a laser driver circuit substrate 601 and transformed to a parallel light beam by a collimator lens 602 and a cylindrical lens 603 enters into a polygon mirror 604 rotating at a constant speed by a scanner motor 605. The laser beam reflected by the polygon mirror 604 is irradiated onto ~~to~~ the photosensitive drum 202 via an objective lens 606 disposed in front of the polygon mirror 604 and a reflection mirror 607 for scanning in the main scanning direction.

FIG. 3 is a block diagram showing the essential part configuration of the control portion 100. The control portion 100 comprises a digital image processing portion 113, a CPU 301 having an interface I/F for exchanging information for control with ~~against~~ a printer control I/F 218 and an external I/F 116 and an operating portion 303, and a memory unit 302. The memory unit 302 comprises a RAM 305 for transferring ~~providing the~~ work area data to the CPU 301, and a ROM 304 for storing a ~~the~~ control program for the CPU 301. The ROM 304 stores a control program for executing ~~the~~ operation modes ~~later~~ described later, such as the automatic color selecting (ACS) mode for automatically changing over between ~~the~~ color image formation and ~~the~~ black and white image formation, the color image forming mode (~~it is~~ also referred to as the color mode), and the black and white image forming mode. ~~mode;, and~~ The ROM 304 also stores a control program for controlling the entire image forming apparatus 50. The ~~Moreover, the~~ operating portion 303 comprises a liquid crystal display with a touch panel for displaying ~~notifying the~~ process execution content input ~~input,~~ and other ~~the~~

information warnings, ~~the warning,~~ or the like concerning the process ~~by the operator~~.

FIG. 4 is a block diagram showing the configuration of a control circuit of the rotary color developing device 203. A developing operation is executed whereby ~~according to a rotating operation of~~ the rotary color developing device 203 is rotated around the rotation shaft 200 by ~~the~~ rotation of the stepping motor 1301 so as to selectively bring ~~selectively~~ the developing devices 221 to 224 ~~corresponding to the separated color to be developed~~ into a developing position in contact with (or adjacent to) the photosensitive drum 202 ~~about the rotation shaft 200~~. The developing device is selected according to the separated color to be developed. The control circuit of the rotary color developing device 203 comprises a stepping motor 1301, a motor driver 1302, a CPU 301 for a main body controlling portion 100, a memory unit 302 having a ROM 304 and a RAM 305 ~~a ROM 304 and a RAM 305 as the breakdown of a memory 302~~, and an optical sensor 1006. The CPU 301 of the main body control portion 100 outputs a pulse to the motor driver 1302 for controlling the stepping motor 1301 when ~~at the time of~~ rotating the rotary color developing device 203. Moreover, the program stored in the ROM 304 of the main body control portion 100 determines the rotating operation state, the home position (hereinafter referred to as the "HP"), and the stopping position according to a ~~the~~ relationship between the pulse output and ~~the~~ detection of the home position flag 1007 by the optical sensor 1006.

FIG. 5 is a diagram showing the configuration of the operating portion 303. The operating portion 303 comprises a ten key number pad ~~ten keys~~ 31, a start key 32, a stop key 33, an LCD 34, and a user mode key 35. Here, the ten key

number pad ~~ten keys~~ 31 includes ~~are~~ keys which allow the user to input ~~be used for inputting~~ the number of copies, the image moving amount at the time of copying, or the like ~~by the user~~. The user presses key 32 to start ~~The start key 32 is a key to be pressed down by the user at the time of starting~~ a copying job. The user presses key 33 to stop a ~~started~~ job in progress. ~~The stop key 33 is a key to be pressed down by the user at the time of stopping a started job by halfway.~~ The LCD 34 is a display portion for displaying the operation state of the image forming apparatus 50. Further, the LCD 34 is provided with a panel switch which allows the user to set the job mode ~~such that the copying job mode can be set by the user via the panel switch~~.

The user presses mode key 35 in order to display ~~is a key to be pressed down by the user at the time of displaying~~ the user mode screen on the LCD 34. In the user mode screen, the user can set a ~~the~~ standard operation of the copying machine ~~can be set by the user, for example~~, including the specifications for every function of the image forming apparatus ~~50, such as setting of~~ 50. For example, the user can set the mode to be selected as the standard mode (default) if the user does not expressly designate a mode. ~~in the case any of the~~ One mode is the automatic color selecting (ACS) mode described later, which changes over between color image formation and black and white image formation depending on ~~of determining~~ whether the image to be formed is a color image or a black and white image. ~~so as to change over the color image formation and the black and white image formation,~~ Other modes include the color image forming mode (~~it is~~ also referred to as the color mode), and the black and white image forming mode (~~it is~~ also referred to as the black and white mode). In the user control screen, the

user can also set the paper size as ~~is not designated expressly by the user, setting of whether or not the~~ longitudinal or ~~size and the~~ lateral if ~~size are inputted for the paper size in the case~~ the paper size at the time of the black and white image formation is a non-fixed size ~~paper, setting of~~ paper. In the automatic color selecting mode, if the paper size is non-fixed, the operator can use the user mode screen to determine whether the paper size (longitudinal or lateral) is input ~~longitudinal and lateral sizes of the paper are inputted~~ initially or ~~the longitudinal and lateral sizes are inputted~~ at the time the color original is detected ~~in the case the paper size at the time of the automatic color selecting mode is a non-fixed size paper, or the like can be selected~~.

FIG. 6 is a diagram showing the display screen in the standard state of the LCD 34. In the "copy" screen 40, ~~the~~ numerals 41, 42 designate buttons for setting the magnification at the time of image formation. Numeral ~~The numeral~~ 43 designates a paper size selecting button for selecting the paper size (such as one of ~~the~~ various kinds of ~~the~~ standard sizes, and ~~the~~ non-fixed size papers). Numerals ~~The numerals~~ 44, 45, 46 designate buttons for executing the automatic color selecting (ACS) mode, the color image forming mode, and the black and white image forming mode, respectively. Only one button can be selected at a time. Numerals ~~One of the three buttons is exclusively selected without being selected simultaneously. The numerals~~ 47, 48, 49 designate buttons for adjusting the printing density of the image. Numeral ~~The numeral~~ 51 designates a button for designating other processes, ~~the process~~ such as stapling or other finishing processes, that are ~~to be~~ executed on ~~for~~ the recording paper stack in the delivery paper processing device (not shown). Numeral ~~The numeral~~ 52 designates a button

for selecting how the image is to be arranged (copy type). ~~among the types of a copying~~ Copy types include: from one side to one side, ~~a copying~~ from one side ~~sides~~ to two sides, ~~a copying~~ from two sides to one side ~~sides~~, and ~~a copying~~ from two sides to two sides. Numeral ~~The numeral~~ 53 designates a button for selecting among ~~designating~~ various ~~kinds of~~ application modes.

FIG. 7 is a block diagram showing the detailed configuration of the digital image processing portion 113 on FIG 1. An original on the original glass stand 101 (to be explained in detail) reflects ~~a light~~ light from ~~the~~ light sources 103, 104 so that the reflected light is guided to the CCD 111 ~~so as to be~~ and transformed into an electric signal (in the case the CCD 111 is a color sensor, it may ~~be one with the~~ have RGB color filters mounted on a one ~~the one~~ line CCD in the order of R, G, and B by inline, or it may have ~~be~~ a three line CCD with an R ~~the R~~ filter, a G ~~the G~~ filter and a B ~~the B~~ filter arranged for each CCD, or it may have ~~be one having~~ a filter ~~in~~ on-chip, or it may have ~~one having~~ a filter independent ~~independently~~ from the CCD). Then, the electric signal (analog image signal) is input ~~inputted~~ to the digital image processing portion 113, sample-held (S/H) by a Clamp & Amp & S/H & A/D portion 502, with the dark level of the analog image signal clamped to the reference potential. The signal ~~potential, it~~ is amplified to a predetermined amount (the above-mentioned processing order is not limited to the order of description), and A/D transformed into, for example, an 8-bit digital ~~a digital~~ signal ~~of 8 bit each~~ for RGB. Then, the RGB signals are processed for the shading correction and ~~the~~ black correction in a shading portion 503. Then, in the case the CCD 111 is a three line CCD, since the reading position in the piecing process differs between the lines, the delay amount is adjusted in a Piecing and MTF

Correction and Original Detecting Portion 504, which corrects the signal timings so that the reading position is the same for the three lines. ~~for each~~ Each line is adjusted according to the reading rate ~~in a piecing & MTF correction & original detecting portion 504 for correcting the signal timings so as to have the same reading position for the three lines~~. Since the reading MTF differs depending on the reading rate and the magnification ratio in the MTF correction, the change is corrected. In the original detection, the original size is recognized by scanning the original on the original glass stand 101. The digital signals with the corrected reading position timing are used by the input masking portion 505 to ~~corrected~~ correct the spectral characteristics of the CCD 111 and the spectral characteristics of the light sources 103, 104 and the reflective troughs ~~troffers~~ 105, 106 ~~by an input masking portion 505~~. The output from the input masking portion 505 is input ~~inputted~~ to a selector 506 and is switchable to an external I/F signal. The signal output ~~outputted~~ from the selector 506 is input to ~~inputted~~ a Color Space Compression & Background Removal & LOG Transforming Portion 507 and a background removing portion 514. After having the background eliminated, the signal input ~~inputted~~ to the background removing portion 514 is input ~~inputted~~ to a black letter discriminating portion 515, which detects ~~for detecting~~ black letters in the original in order to produce ~~for producing~~ a black letter signal from the original. In addition, the color space compression is determined in the Color Space Compression & Background Removal & LOG Transforming Portion 507, after the ~~with the~~ other output from the selector 506 ~~inputted the~~ has been input. The color space compression is determined according to whether the image signal is within a range that can ~~to~~ be reproduced by the printer. In the case it is within the range, it

is left as it is, and in the case it is out of the range, the image signal is corrected so as to be within the range that can ~~to~~ be reproduced by the printer. Then, the background removing process is carried out, and the image signal ~~it~~ is transformed from an RGB ~~the RGB~~ signal to a YMC ~~the YMC~~ signal in the LOG Transforming Portion. In order to correct ~~For correcting~~ the timing of the signal produced in the black letter discriminating portion 515, the timing of the output signal from the Color Space Compression & Background Removal & LOG Transforming Portion 507 is ~~has the timing~~ adjusted in the Delaying Portion 508. The two kinds of signal undergo ~~the signals have~~ a moiré elimination process in a Moiré Removing Portion 509, and are zoom-processed in the main scanning direction in a Zoom Processing Portion 510. The ~~In a UCR & masking & black letter reflecting portion 511, for the~~ signal processed in the Zoom Processing Portion 510 is input to a UCR and Masking and Black Letter Reflecting Portion 511. A ~~510, a~~ YMCK signal is produced from the YMC signal by the UCR process so as to be corrected into a signal according to the output of the printer in the masking processing portion. A ~~as well as a~~ discriminating signal produced in the Black Letter Discriminating Portion 515 is fed back to the YMCK signal. The signal processed in the UCR & Masking & Black Letter Reflecting Portion 511 is density-adjusted ~~has the density adjustment~~ in a γ Correcting Portion 512, then undergoes a smoothing or edge process in a Filtering Portion 513. The processed signal is transmitted to the Printer Portion 2.

FIG. 8 is a diagram showing the process after receipt in the Printer Portion 2 of the signal processed in the digital image processing portion. The received eight-bit multi-value signal is transformed into a binary signal in a Binary

Transforming Portion 401. For ~~As to~~ the transforming method, any of a dither method, an error diffusion method, an improved error diffusion, or the like can be used. The transformed binary signal is transmitted to the external I/F 116 and the Delaying ~~delay~~ Portion 402. In the external I/F 116, as needed, the received signal is transmitted to an external output device such as a facsimile (not shown). In order to correct ~~For correcting~~ the received signal and the laser light emission timing of the laser scanner portion 201, the Delay Portion 402 adjusts the timing for transmission to the Laser Scanner Portion 201.

FIGS. 9A, 9B, 9C, 9D, 9E and 9F are diagrams showing respective stopping positions of the rotary color developing device ~~devices~~ 203. The rotary color developing device 203 is maintained at a predetermined rotation position, that is, at the HP position 701, except at the time of image formation. The HP position 701 is a position with the visualizing portion 226 disposed between the black developing device 221 and the cyan developing device 224. In the case the rotary color developing device 203 is rotated to the HP position, the CPU 301 uniformly rotates the stepping motor 1301 via the motor driver 1302 such that the rotary color developing device 203 is moved to the HP position (FIG. 9A) by rotating the motor in ~~for~~ predetermined pulses. The rotation begins at ~~from~~ the time the optical sensor 1006, ~~1006~~ mounted in the vicinity of the rotary color developing device 203, ~~203~~ detects the home position flag 1007.

The home position detecting operation for moving the rotary color developing device 203 to the HP position (FIG. 9A) is executed each time ~~when~~ the power source of the image forming apparatus 50 is switched on, the apparatus is switched ~~recovered~~ from the low power consumption mode to normal operating

~~the ordinary~~ mode, the front door cover (not shown) of the image forming apparatus 50 is closed after correcting a ~~by the~~ jamming process, or the like, or ~~and~~ the black developing process finishes during ~~is finished in the~~ image formation.

At the time of the home position detecting operation, even in the case pulses corresponding to one revolution are transmitted to the stepping motor 200 for rotating the rotary color developing device 203, if the optical sensor 1006 does not detect the home position flag 1007, the rotating operation of the rotary color developing device 203 is determined to be abnormal by the program stored in the ROM 304 of the main body control portion 100. ~~Further, the~~ The detection result output from the optical sensor 1006 is transmitted to the CPU 301 of the main body control portion 100, ~~100~~ as shown in FIG. 4. ~~Moreover, the~~ The pulse transmission to the stepping motor 200 for rotating the rotary color developing device 203 is transmitted ~~executed~~ from the CPU 301 of the main body controlling portion 100 to the motor driver 1302 for controlling the stepping motor 200.

Finally, details of the control of the rotary color developing device 203, which are characteristic of this embodiment, will be explained with reference to FIGS. 9A to 9F, and FIG. 10. ~~In the~~ The image forming apparatus 50 shown in this embodiment prepares the image modes, which include the color mode, the black and white mode, and the auto color select (ACS) mode. The ACS mode changes ~~for changing~~ over between ~~the~~ color image formation and ~~the~~ black and white image formation depending on ~~by determining~~ whether the original image is a color image or a black and white image ~~as the image forming mode, are prepared~~. It ~~The ACS (Auto Color Select) mode is a mode of~~ automatically recognizes ~~recognizing~~ whether the original image is monochrome or colored when ~~at the time~~

~~of reading~~ the original is read by the reader portion 1, and executes ~~executing~~ the image forming process in the black and white mode (~~it is~~ also referred to as the monochrome mode) in the case the original image is monochrome, and in the ~~mode equivalent to the~~ color mode in the case the original image is colored ~~of colors~~.

Here, the process in the ACS mode will be explained. When ~~In the case~~ the operator presses ~~down~~ the copy starting button 32 in the operating portion 303, a reading ~~the reading~~ operation for the original placed on the original glass stand 101 is started in the reader portion 1 and ~~as well as~~ the image forming operation starting command (S801) is transmitted to the printer portion 2.~~, so that~~ Receipt of this command starts the drive of the photosensitive drum 202 and the peripheral units (such as the intermediate transfer member 205) ~~is started~~ in the printer portion 2 ~~with the command received~~. At this ~~the~~ time, it is determined whether or not the image forming mode is the ACS mode (S802). In the case it is not the ACS mode, the rotary color developing device 203 is on stand by at the HP position (FIG. 9A). Thereafter, when the image forming preparations are made in the printer portion 2, the image information is transmitted from the reader portion 1. It is determined whether the received image information is monochrome or colored (S807). In the case the original image is black monochrome, the rotary color developing device 203 is rotated counterclockwise to the black developing position (FIG. 9B) (S808) so as to change over the developing device. In order to visualize the electrostatic latent image by adhering a toner, the rotary color developing device 203 should be rotated to the black developing position (FIG. 9B) before the electrostatic latent image formed at the laser irradiating position 225 reaches ~~at~~ the visualizing position 226 in which the photosensitive drum 202 and one of the sleeves of the

developing devices 221 to 224 are opposite ~~to~~ each other. That is, the electrostatic latent image formation starting time should be after the time calculated by the following formula:

(Time T1 for completing the rotation of the rotary color developing device 203 from the HP position (FIG. 9A) to the black developing position (FIG. 9B)) – (Time T2 needed for moving the electrostatic latent image from the laser irradiating position 225 to the visualizing position 226).

In contrast, in the case the original image is colored, the rotary color developing device 203 is rotated counterclockwise from the HP position (FIG. 9A) to the yellow developing position (FIG. 9C) (S809) ~~for changing over the developing device~~ so as to be rotated successively to the magenta developing position (FIG. 9D), the cyan developing position (FIG. 9E), and the black developing position (FIG. 9B). In this case, the electrostatic latent image formation starting time should be after the time calculated by the following formula:

(Time T3 for completing the rotation of the rotary color developing device 203 from the HP position (FIG. 9A) to the yellow developing position (FIG. 9C)) – (Time T2 needed for moving the electrostatic latent image from the laser irradiating position 225 to the visualizing position 226).

In the above-mentioned example, the developing device is changed over by rotating the rotary color developing device 203 from the HP position (FIG. 9A) to the black developing position (FIG. 9B) (S808) or to the yellow developing position (FIG. 9C) (S809) at the time the original image color is determined to be

monochrome or colored (S807). At this ~~the~~ time, ~~since~~ the above-mentioned times satisfy the below-mentioned relationship:

T1 > T2, T3 > T2,

Thus, the ~~The~~ rotation time of the rotary color developing device 203 shown by T1 and T3 is the obstacle in shortening the FCOT.

In order to overcome this ~~cope with the~~ problem, in the case of the ACS mode (S802), when the operator presses down the copy starting button 32 in the operating portion 303, the rotary color developing device 203 is rotated from the HP position (FIG. 9A) to the black developing position (FIG. 9B) (S803) so as to be on standby thereat. Then, in the case the original image is black monochrome (S805), the electrostatic latent image formation is started immediately (S810). In contrast, in the case the original image is colored, the rotary color developing device 203 is rotated counterclockwise from the black developing position (FIG. 9B) to the yellow developing position (FIG. 9C) (S806), so that the electrostatic latent image formation is started at the time ~~timing corresponding to~~ the rotation is completed ~~completing time~~ (S810).

Thereby, the rotation time of the rotary color developing device 203 is shortened to zero in the case the original image is black monochrome, and to the rotation time from the black developing position (FIG. 9B) to the yellow developing position (FIG. 9C), in the case the original image is color. ~~so that~~ Thus, the electrostatic latent image formation starting timing can be made earlier. ~~As a result,~~ and the real average value of the FCOT can be reduced ~~made smaller~~.

(Other embodiments)

Although the mounting order of the developing devices is set in the order of black, yellow, magenta, and cyan in the clockwise direction, ~~direction~~ as shown in the structural example I (FIG. 9A) in this embodiment, ~~embodiment~~ so as to have the developing order of yellow, magenta, cyan, and black in the case the original image is colored, the mounting order of the developing devices and the developing order are not particularly limited thereto. For example, as shown in the structural example II (FIG. 9F), the mounting order can be magenta, cyan, yellow, and black in the clockwise direction, with the HP position as the visualizing position 226 disposed between the magenta developing device 223 and the black developing device 221 (FIG. 9F). If the developing order ~~in the case the original image is colored~~ is magenta, cyan, yellow, and black, then when the copy starting button is pressed down in the ACS mode, first, the black developing device 221 is rotated from the HP position (FIG. 9F) to the visualizing position 226 in the counterclockwise direction so as to be on standby thereat. In the case the original image is black monochrome, the electrostatic latent image formation is started immediately. In contrast, in the case the original image is colored, the rotary color developing device 203 is rotated from the black developing position to the magenta developing position, so that the electrostatic latent image formation starts ~~is started~~ at the ~~timing corresponding to the~~ rotation completing time. This is effective for shortening the FCOT, ~~FCOT~~ particularly in the case the original image is frequently black monochrome. In addition thereto, in the case the original image is frequently colored, first, it is rotated from the HP position to the magenta developing position so as to be on standby thereat. Then, in the case the original image is colored, the electrostatic latent image formation is started immediately. In

contrast, in the case the original image is black monochrome, the rotary color developing device 203 is rotated from the magenta developing position to the black developing position so as to start the electrostatic latent image formation at the ~~timing corresponding to the~~ rotation completing time ~~timing~~.

In another ~~A~~ configuration, ~~wherein~~ the change-over of the standby position ~~corresponding to the frequency~~ may be set by the operator or set automatically ~~can be used as well~~. The change-over method of the standby position ~~corresponding to the frequency~~ will be explained. In the case the operator presses down the user mode key 35, the user mode screen is displayed on the LCD 34 (not shown). In the above-mentioned user mode screen, any ~~either~~ of the color image forming mode, the black and white image forming mode, and the ACS mode can be selected. For example, in the case the original image is frequently colored, the operator may designate ~~designates~~ the color image forming mode as the standby position ~~at the time of the ACS mode~~ in the above-mentioned user mode screen. When ~~That is, in the case~~ the copy command is executed ~~provided~~ under this ~~the~~ setting, the rotary color developing device 203 is rotated from the HP position to the magenta developing position so as to be on standby thereat. In the case the original image is colored, the electrostatic latent image formation is started immediately.

In addition, although the image forming mode is explained in this embodiment as the ACS mode, ~~case of the ACS is explained in this embodiment as the image forming mode~~, the image forming mode is not ~~particularly~~ limited to the ACS mode. ~~ACS , and it~~ The image forming mode may be the total mode including the monochrome mode and the color mode. This can be adopted in an

apparatus with a ~~the~~ configuration wherein ~~having~~ the copy mode information selected in the reader portion 1 is not transmitted to ~~notified in~~ the printer portion 2 until the image information is received.

Further, although the intermediate transfer member 205 is shown as the drum in this embodiment, the intermediate transfer member is not ~~particularly~~ limited to a drum; for example, ~~the drum, and~~ it may have a belt-like shape. Furthermore, although ~~the~~ developing devices of the four colors including black, yellow, magenta, and cyan are provided in the rotary color developing device in this embodiment, the developing devices provided in the rotary color developing device are not ~~particularly~~ limited thereto. For example, the developing devices of the three colors including yellow, magenta, cyan may be provided in the rotary color developing device, and the black developing device may be provided independently in the vicinity of the latent image bearing member. ~~As the operation in~~ In this case, when ~~in the case~~ the printer portion 2 receives the developing device starting command, the rotary color developing device is rotated to the vicinity of the yellow developing position so as to be on standby thereat. After making a determination as to ~~on~~ whether the original image is monochrome or colored, in the case it is black monochrome, the electrostatic latent image formation is started immediately using the black developing device provided independently in the vicinity of the latent image bearing member. In contrast, in the case it is colored, the yellow developing device, ~~position~~ being on standby in the vicinity of the yellow developing position, is rotated to the developing position so as to start the electrostatic latent image formation.

Moreover, for example, the developing devices may include ~~of~~ the six colors of ~~including~~ black, yellow, thick magenta, thin magenta, thick cyan, and thin cyan ~~may be provided~~. In this case, two color modes are provided: ~~As the operation in this case, by providing~~ a high speed color mode for image formation using the four colors including black, yellow, thick magenta, and thick cyan ~~as the first mode~~, and an image ~~a image~~ quality priority color mode for image formation using the six colors including black, yellow, thick magenta, thin magenta, thick cyan, and thin cyan. The ~~as the second mode, according to determination by the~~ automatic discriminating ACS mode can ~~for~~ automatically determine whether ~~discriminating the kind of~~ the input ~~inputted~~ image ~~on whether it~~ is a letter image or a graphic image, and ~~it~~ can be set in the user mode screen so as to select the image quality priority color mode when ~~in the case of requiring~~ a higher image quality is required. When ~~In the case~~ the printer portion 2 receives the developing device starting command, the rotary color developing device is rotated to the vicinity of the thin magenta developing position, which is ~~to be~~ used initially in the image quality priority color mode, so as to be on standby thereat. A ~~After making~~ determination is made as to ~~on~~ whether the original image is a letter image or a graphic image. In ~~, in~~ the case it is a letter image, the rotary color developing device ~~it~~ is rotated from the thin magenta developing position to the thick magenta developing position so as to start the electrostatic latent image formation at the time ~~timing corresponding to~~ the rotation is completed ~~completing time~~. In the case the original image ~~it~~ is a graphic image, the electrostatic latent image formation is started immediately using the thin magenta developing device.

Further, for example, two black developing devices can be provided: ~~for~~

~~the black color, by providing~~ a mono-component black developing device for letters, and ~~providing~~ a two-component black developing device for graphics. These devices ~~, they~~ can be ~~used~~ selected ~~optionally~~ according to the mode, ~~mode,~~ that is, the mono-component device can be used by the letter priority mode and the two-component device can be used by the image quality priority mode.

Furthermore, the original image is not limited to a paper ~~the paper~~ original read by the CCD 111 of the reader portion 1; rather, ~~but~~ it may be an image from a personal computer connected to ~~with~~ the external I/F in FIG. 3. That is, although the process of the image forming operation at the time of the copying operation has been explained in this embodiment, the image forming operation is not ~~particularly~~ limited to the copy operation, and it may occur ~~be a process~~ at the time of the printer operation or the facsimile operation.

ABSTRACT OF THE DISCLOSURE

~~In an~~ An image forming apparatus ~~including~~ includes a latent image bearing member and a developing portion having a plurality of developing devices provided facing the latent image bearing member, ~~since~~ as well as an inputting portion for inputting an image signal, an auto-discriminating portion for automatically discriminating the kind of ~~an inputted~~ image input, and a control portion for changing ~~over~~ between a first mode for executing monochrome image formation, a second mode for executing color image formation, and an auto-selecting mode for changing over between the first mode and the second-mode according to the discrimination of the auto-discriminating portion. ~~capable of controlling such that~~ In the auto-selecting mode, movement of a predetermined developing device to a predetermined position is started before the auto-discriminating portion makes the discrimination. ~~in the case the auto-selecting mode is selected, are provided, at the time of starting the image formation by the auto-selecting mode, the developing device can be provided to the vicinity of the developing position so as to shorten the real average value of the FCOT by preliminarily rotating the developing device changeover portion to a standby position as the predetermined position so as to be rotated by the remaining angle to the developing position of the developing device after being turned out whether the image to be formed is monochrome or colored.~~